REMARKS

The Applicants appreciate the Examiner's thorough examination of the application and request reexamination and reconsideration of the application in view of the above amendments and the following remarks. To simplify the issues for prosecution, Applicants herein cancel claims 1-3 and 7-8. Claims 4-6 and 9-10 remain pending in the application. The amendments presented herein do not raise any new issues since Applicants have only cancelled claims.

Claims 1, 3, 4, 6, 7, and 9 stand rejected under 35 U.S.C. §102(e) as allegedly being anticipated by U.S. Patent No. 5,973,518 to Vallancourt (hereinafter "Vallancourt").

The subject invention results from the realization that, in a feedback system in which the output closely tracks the input, the error signal is small, and so rather than sample both the input and feedback signals before taking the difference to create the error signal, it is more efficient to form the error signal with a continuous-time (non-sampling) circuit followed by a gain stage and then sample this amplified error signal using a switched-capacitor circuit. This arrangement causes the input-referenced switch thermal noise to be reduced by the amount of the gain used in the error path. The amount of gain that can be used in the error path depends on how closely the output tracks the input; it is desirable to make this gain as large as possible without causing the error signal to exceed the supply voltage.

Vallancourt shows a sample and hold circuit that can be powered with a low voltage supply, e.g., of about 1 volt. Referring to Fig. 3, to which the Examiner cites, Vallancourt shows a sample and hold circuit that includes an operational amplifier OA4 which accepts as an input an analog feedback signal. The output of the sample and hold circuit can be sent to other circuitry, such as an analog-to-digital converter. Vallancourt does not disclose, however, "a quantizer circuit for quantizing the output of [a] filter circuit; [and] a feedback circuit,

responsive to said quantizer circuit, for delivering to said input circuit said quantized feedback signal" as claimed by the Applicants.

The Examiner cites the following passage of Vallancourt as allegedly disclosing a quantizer as part of a filter system:

> A sample and hold (S/H) circuit repeatedly captures and maintains a single sample of either the current or voltage of a time-varying signal long enough *for an analog-to-digital converter (ADC) or other subsequent circuit* to utilize that stabilized sample. Without a sample and hold circuit, the accuracy of *the ADC or other circuitry following the sample and hold circuit* would deteriorate due to their vulnerability to fluctuations in the input signal during the length of time that the sample is being utilized by *subsequent circuitry*.

Vallancourt at column 2, lines 19-27 (emphasis added). Thus, those skilled in the art will understand that Vallancourt describes using an analog to digital converter *after* the disclosed circuits, not as a part of any of the disclosed circuits. Moreover, Vallancourt does not disclose using a quantizer as part of a feedback loop and also does not disclose a $\Sigma\Delta$circuit.

Additionally, Vallancourt clearly fails to disclose a circuit for reducing input-referred thermal noise by a factor of approximately the gain of the amplification.

Claim 4 of the subject invention recites: "A $\Sigma\Delta$ modulator with a filter system having reduced switch thermal noise comprising: an input circuit for receiving an input signal and a quantized feedback signal and providing a signal representative of the difference; a filter circuit including at least an input sampling capacitor and switch which introduces thermal noise error; a quantizer circuit for quantizing the output of said filter circuit; a feedback circuit, responsive to said quantizer circuit, for delivering to said input circuit said quantized feedback signal; and said input circuit including means for amplifying said difference signal, before it is submitted to said filter circuit to reduce the input-referred thermal noise by a factor of approximately the gain of the

amplification." Vallancourt does not disclose or suggest such a structure because Vallancourt does not disclose a ΣΔ modulator circuit having a quantizer that quantizes the output of a filter circuit.

Also, Vallancourt does not disclose the subject matter of independent claim 9, which recites: "A ΣΔ modulator with a filter system having reduced switch thermal noise comprising: a summing circuit for receiving an input signal and a quantized feedback signal and providing a signal representative of the difference; a filter circuit including at least an input sampling capacitor and switch which introduces thermal noise error; a quantizer circuit for quantizing the output of said filter circuit; a feedback circuit, responsive to said quantizer circuit, for delivering to said summing circuit said quantized feedback signal; and an amplifier circuit for amplifying said difference signal, before it is submitted to said filter circuit to reduce the input-referred thermal noise by a factor of approximately the gain of said amplifier circuit." Vallancourt also does not disclose or suggest such a structure because Vallancourt does not disclose a ΣΔ modulator circuit having a quantizer.

Accordingly, Vallancourt does not disclose or suggest the structure of the claims of the subject application as amended. Applicants respectfully request that the Examiner remove the rejections under 35 U.S.C. §102(e).

Claims 2, 4, 8, and 10 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Vallancourt. Applicants have cancelled claims 2 and 8 herein. Independent claim 4 is patentable for the reasons stated above. Claim 10 depends from independent claim 9 and thus incorporates the features of claim 9 and also includes one or more additional features that distinguish over Vallancourt. As such, claim 10 is patentable for at least the reasons stated above.

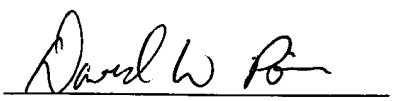
Vallancourt does not make obvious the subject invention because one skilled in the art would have no motivation to include a quantizer within the feedback loop of any of the Vallancourt circuits. Vallancourt provides no teaching or suggestion to include a quantizer within a feedback loop. In fact, Vallancourt actually teaches away from using a quantizer within a feedback loop because the feedback loops of Vallancourt carry analog signals and are coupled directly to an analog operational amplifier. Thus, Vallancourt does not disclose or suggest "a quantizer circuit for quantizing the output of said filter circuit; [and] a feedback circuit, responsive to said quantizer circuit, for delivering to said input circuit said quantized feedback signal" as claimed by the Applicants.

Accordingly, Vallancourt does not make obvious the claims of the subject invention. Applicants respectfully request that the Examiner withdraw the rejections under U.S.C. §103(a).

Each of the Examiner's rejections has been addressed or traversed. Accordingly, it is respectfully submitted that the application is in condition for allowance. Early and favorable action is respectfully requested.

If for any reason this Response is found to be incomplete, or if at any time it appears that a telephone conference with counsel would help advance prosecution, please telephone the undersigned or his associates, collect in Waltham, Massachusetts, at (781) 890-5678.

Respectfully submitted,



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